



ORIGINAL RESEARCH PAPER

Surgery

"A COMPARATIVE STUDY BETWEEN DIAGNOSTIC ACCURACY OF C-REACTIVE PROTEIN AND TOTAL LEUKOCYTE COUNT IN ACUTE APPENDICITIS"

KEY WORDS:

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ABSTRACT

The present study is titled "A comparative study between diagnostic accuracy of c-reactive protein and total leukocyte count in acute appendicitis" This is an observational study is conducted in our institute which included (clinically and ultrasonographically diagnosed) cases of acute appendicitis presenting to surgery OPD or the emergency department between 01/01/2015 to 30/06/2016(18 months). This study has included 100 patients of which 60 were males and 40 were females between 11-65 years. Ultrasonography (abdomen and pelvis) has been done to confirm the diagnosis made on clinical examination, considering ultrasonography as a gold standard procedure for the diagnosis of acute appendicitis and then C-reactive protein and Total leukocyte count has been measured. The histopathological analysis showed changes of acute appendicitis in 96 patients (96%) and normal appendix in 4 patients (4%). Out of 96 patients whose histopathological analysis showed changes of acute appendicitis, 71 were acute non complicated appendicitis and 25 were acute complicated appendicitis (gangrenous or perforated etc). Most common age group for acute non complicated appendicitis in males was between 31-40 years. Most common age group for acute complicated appendicitis in males was between 21-30 years. Whereas most common age group for acute non complicated appendicitis in females was between 11-20 years. Most common age group for acute non complicated appendicitis in males was between 21-30 years. The diagnostic accuracy of TLC is 90% whereas diagnostic accuracy of CRP is 79%.

INTRODUCTION

The Vermiform appendix present only in human beings, certain arthropod apes and the wombat (a nocturnal, burrowing Australian marsupial) was probably first noted as early as the Egyptian civilization (3000 B.C). During the mummification process, abdominal parts were removed and placed in Coptic jars with inscriptions describing the contents as "worm of the intestines" were discovered⁽¹⁾.

The Vermiform appendix is considered by most to be a vestigial organ, its importance in surgery due mainly to its propensity for inflammation that results in the clinical syndrome known as acute appendicitis. Acute appendicitis is the most common cause of "acute abdomen" in young adolescents and appendectomy is often the first major procedure performed by a Surgeon in training^(2,3,4).

Variations in the position of the appendix, age of the patient and degree of inflammation make the clinical presentation of appendicitis notoriously inconsistent. Misdiagnosis in different age groups is from 10 to 33%⁽⁵⁾. Despite extraordinary advances in modern diagnostic imaging and diagnostic laboratory investigations, the diagnosis of appendicitis remain essentially clinical requiring a mixture of observations, clinical acumen and surgical sense.

women, with approximately 7% of all people undergoing appendectomy for acute appendicitis during their lifetime. Over the 10-year period from 1987 to 1997, the overall appendectomy rate decreased in parallel with a decrease in incidental appendectomy.^[6,7] However, the rate of appendectomy for appendicitis has remained constant at 10 per 10,000 patients per year. [8] Appendicitis is most frequently seen in patients in their second through fourth decades of life, with a mean age of 31.3 years and a median age of 22 years. There is a slight male: female predominance (1.2 to 1.3:1).^[6,7] Despite the increased use of ultrasonography, computed tomography (CT), and laparoscopy, the rate of misdiagnosis of appendicitis has remained constant (15.3%), as has the rate of appendicular rupture.

The percentage of misdiagnosed cases of appendicitis is significantly higher among women than among men (22.2 vs. 9.3%).

The negative appendectomy rate for women of reproductive age is 23.2%, with the highest rates in women aged 40 to 49 years.

The highest negative appendectomy rate is reported for women >80 years of age (Fig. 30-2).^[7,8]

AIMS AND OBJECTIVES

1. The aim of this study is to compare the sensitivity, specificity, positive predictive value, negative predictive value of c reactive proteins with total leukocyte count in a diagnosed case of acute appendicitis.

2. To interpret how these investigations can be used effectively to improve the diagnosis and decision making of acute appendicitis and hence reduce negative appendectomies.

MATERIALS AND METHODS

Settings-

This study has been conducted in our institute which included (clinically and ultrasonographically diagnosed) cases of acute appendicitis presenting to surgery OPD or the emergency department.

Study design-

It's an observational study.

Study population-

This study has conducted in our hospital which included all the

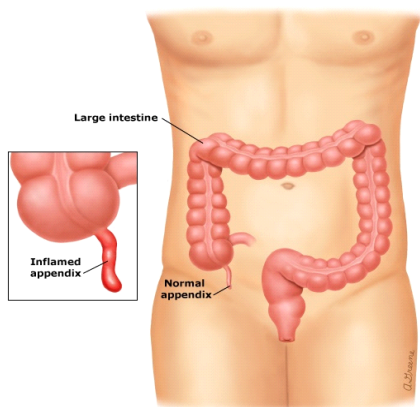


Figure-1: appendix-normal position

The lifetime rate of appendectomy is 12% for men and 25% for

patients admitted with right iliac fossa pain, fever and vomiting and ultrasonography (abdomen and pelvis) suggestive of acute appendicitis.

STUDY DURATION-

Study has been conducted in our institute between 01/01/2015 to 30/06/2016(18 months).

INCLUSION CRITERIA-

1. All the patients coming with sudden onset of abdominal pain (right iliac fossa pain).

EXCLUSION CRITERIA-

1. Immunocompromised individuals
2. Patients with recurrent appendicitis
3. Patients with appendicular mass
4. Concomitant conditions where c reactive protein or total leukocyte count is elevated
5. Patients with other medical illness like diabetes mellitus, liver diseases or other co-morbid conditions

OUTCOME AND DATA COLLECTION PROCEDURES

1. Inclusion and exclusion criteria have been applied to patients presenting with symptoms of acute appendicitis
2. Patient were educated about the study and only those patients consenting to participate in the study have been included
3. Written informed consent as given in "PATIENT CONSENT FORM" has been taken from every participant included in the study.
4. Details of cases have been recorded including history and clinical examination.
5. Ultrasonography (abdomen and pelvis) has been done to confirm the diagnosis made on clinical examination, considering ultrasonography as a gold standard procedure for the diagnosis of acute appendicitis.
6. C-reactive protein and Total leukocyte count has been measured.

OVERVIEW

- Our study recruited 100 patients, males were 60 patients (60%) and females 40 patients (40%), and the age range was 11-65 years.
- The histopathological analysis showed changes of acute appendicitis in 96 patients (96%) and normal appendix in 4 patients (4%).
- Mean age of female-28.83 years
- Mean age for males-34.33 years
- Mean TLC in acute non complicated appendicitis in males-15.05
- Mean TLC in complicated appendicitis in males- 24.64
- Mean CRP in acute non complicated appendicitis in females-14.77
- Mean CRP in complicated appendicitis in females- 22.82

Table-1: AGE-WISE DISTRIBUTION IN MALES

AGE (in years)	Normal appendix	Acute non-complicated appendicitis	Acute complicated appendicitis
11-20	0	5	3
21-30	0	10	5
31-40	2	19	4

41-50	0	8	1
51-60	0	0	0
61-70	0	2	1

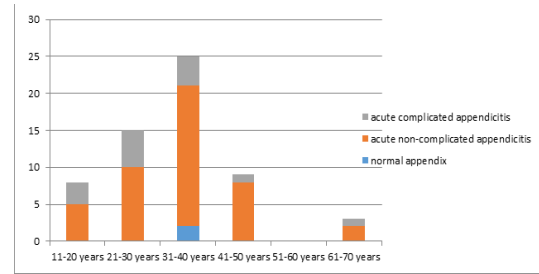


Figure-2: AGE-WISE DISTRIBUTION IN MALES

Table-2: AGE-WISE DISTRIBUTION IN FEMALES

AGE (in years)	Normal appendix	Acute non-complicated appendicitis	Acute complicated appendicitis
11-20	1	10	2
21-30	0	5	4
31-40	1	9	2
41-50	0	3	2
51-60	0	0	1
61-70	0	0	0

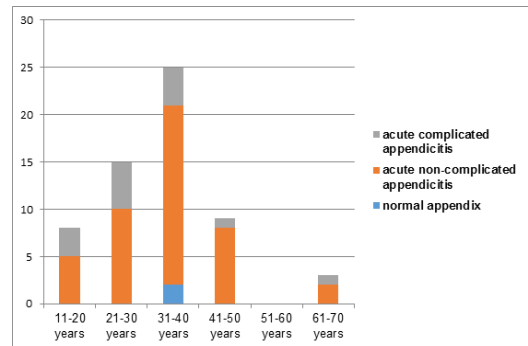


Figure-3: AGE-WISE DISTRIBUTION IN FEMALES

TOTAL LEUCOCYTE COUNTS
Table-3: TOTAL LEUCOCYTE COUNT VARIABLES-

	Acute appendicitis	Normal appendix
TLC - raised	87	1
TLC - not raised	9	3

True positive cases (A) - 87
False positive cases (B) - 1
False negative cases (C) - 9
True negative cases (D) - 3

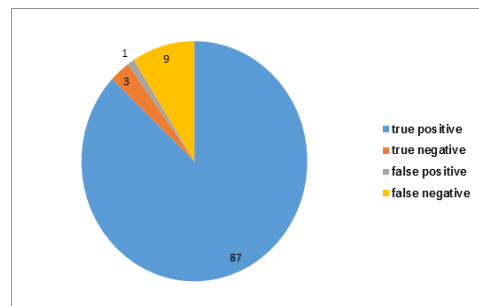


Figure-4: TOTAL LEUCOCYTE COUNT VARIABLES

Sensitivity= $A / (A+C) \times 100 = 87\%$
 Specificity= $D / (D+B) \times 100 = 75\%$
 Positive Predictive Value= $A / (A+B) \times 100 = 98.8\%$
 Negative Predictive Value= $D / (D+C) \times 100 = 25\%$
 Percentage of false negative cases= $C / (A+C) \times 100 = 9.3\%$
 Percentage of false positive cases= $B / (B+D) \times 100 = 25\%$
 Accuracy= $(A+D) / (A+B+C+D) \times 100 = 90\%$

C-REACTIVE PROTEIN COUNTS
Table-4: C-REACTIVE PROTEIN VARIABLES

	Acute appendicitis	Normal appendix
CRP- raised	77	2
CRP- not raised	19	2

True positive cases (A) - 77
 False positive cases (B) - 2
 False negative cases (C) - 19
 True negative cases (D) - 2

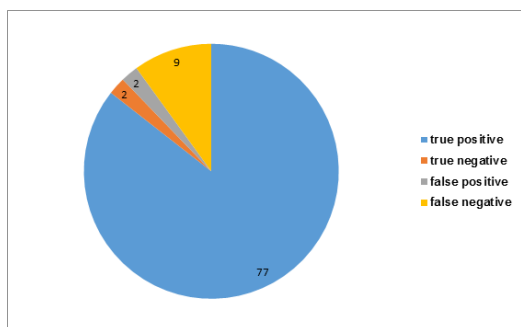


Figure-5: C-REACTIVE PROTEIN VARIABLES

Sensitivity= $A / (A+C) \times 100 = 80.21\%$
 Specificity= $D / (D+B) \times 100 = 50\%$
 Positive Predictive Value= $A / (A+B) \times 100 = 97.47\%$
 Negative Predictive Value= $D / (D+C) \times 100 = 9.5\%$
 Percentage of false negative cases= $C / (A+C) \times 100 = 19.79\%$
 Percentage of false positive cases= $B / (B+D) \times 100 = 50\%$
 Accuracy= $(A+D) / (A+B+C+D) \times 100 = 79\%$

DISCUSSION

Although the incidence of acute appendicitis appears to have been waning slightly over the past few decades, it remains a frequent cause of acute abdominal pain and urgent operative intervention. The analysis of a patient with possible appendicitis can be divided into 3 parts: history, physical examination, and routine laboratory and radiological tests. Almost one-third of patients have atypical clinical features. The wide use of ultra-sonography and computer tomography scan has not effectively decreased the rate of perforated appendicitis or number of negative appendectomies in large population studies

IN OUR STUDY....

Age incidence-

- Mean age of female in cases of acute appendicitis- 28.83 years
- Mean age for males in cases of acute appendicitis- 34.33 years

SEX INCIDENCE-

- male: female is 3:2(60% males and 40% females)

TOTAL LEUCOCYTE COUNT-

- sensitivity, specificity, PPV, NPV of TLC is 87%, 75%, 98.8%, 25% respectively

C-REACTIVE PROTEIN COUNT-

- sensitivity, specificity, PPV, NPV of CRP is 80.21%, 50%, 97.47%, 9.5% respectively
- Comparing diagnostic accuracy between TLC and CRP it is seen that accuracy of TLC is 90% whereas accuracy of CRP is 79%

So as according to our findings we can conclude the discussion by mentioning that "DIAGNOSTIC ACCURACY OF TLC IS BETTER THAN DIAGNOSTIC ACCURACY OF CRP".

CONCLUSION

Acute appendicitis is one of the most common causes of hospital admission in the emergency settings, and appendectomy is one of the most common surgical procedures all over the world and despite the advancement in the diagnostic and laboratory methods still the rate of negative appendectomy is 15–30%.

Health systems nowadays are driven by the cost effectiveness; thus, many studies evolved to find tests that could increase the accuracy of diagnosis and reduce the number of unnecessary operations.

C-reactive protein (CRP) and white blood cell count (WCC) are inflammatory markers used in the diagnosis of infection.

The white cell count and C-reactive protein measurements are useful in the assessment of acute appendicitis: if used judiciously, they may spare a group of patients not only an unnecessary surgical procedure, but also unnecessary admission to hospital for

OBSERVATION

Appendicitis remains largely a retrospective diagnosis. However, there is a role for pre-operative WCC and CRP levels in aiding clinical diagnosis.

In our study we found out that TLC is more sensitive and more specific test with higher positive and negative predictive value than CRP assay.

The diagnostic accuracy of TLC is higher than that of CRP assay.

CONSENT FORM

अनुमतिपत्र

1. मैं इस अनुमति पत्र द्वारा A COMPARATIVE STUDY BETWEEN DIAGNOSTIC ACCURACY OF C-REACTIVE PROTEIN AND TOTAL LEUKOCYTE COUNT IN ACUTE APPENDICITIS इस वैद्यकिय उपक्रम में शामिल होने कि सहमति दे रहा/रही हूँ।

2. मुझे इस उपक्रम कि पुरी जानकारी दी गई है और इसमें आवश्यक सभी प्रकार कि जाँचें तथा इनकी गंभीरता एवं संभावित हानि से अवगत किया गया है।

3. इस उपक्रम के दरम्यान होनेवाली सभी दुष्परिणाम; तकनीकी या वैद्यकिय, स्थायी या अस्थायी, तुरंत या दूरगामी के बारे में मुझे जानकारी दी गई है और मुझे प्रश्न पूछने का मौका दिया गया है।

4. मैं यह सभी जानकारी समझने के बाद पुरे होशोहवास में स्वखुशि से इस अनुमतिपत्र पर सही कर रही हूँ

सम्मतीपत्र

1. मी या सम्मतीपत्रद्वारे A COMPARATIVE STUDY BETWEEN DIAGNOSTIC ACCURACY OF C-REACTIVE PROTEIN AND TOTAL LEUKOCYTE COUNT IN ACUTE APPENDICITIS या संशोधनात्मक अभ्यासामध्ये भाग घेणारा एक रूपण म्हणून सम्मती देत आहे.

2.या संशोधनात्मक अभ्यासाची माहिती मला दिली आहे. यात आवश्यक असलेल्या सगळ्या चाचण्या व त्यांची संभावित हानी बदल मला कल्पना दिलेली आहे.

3. या अभ्यासादरम्यान उदभवू शकण्या-या संभाव्य, तंत्रिक व वैद्यकिय, स्थायी अथवा अस्थायी, त्वरित किंवा दुर्गामी परिणामाची माहिती मला दिलेली आहे व मला प्रश्न विचारण्याची संधिही दिलेली आहे.

4. ही सर्व माहिती समजल्यानंतर मे स्वखुशीने या सम्मतीपत्रावर स्वाक्षरी करत आहे

CONSENT FORM

1. I am willing to participate as one of the case for the research

study entitled A COMPARATIVE STUDY BETWEEN DIAGNOSTIC ACCURACY OF C-REACTIVE PROTEIN AND TOTAL LEUKOCYTE COUNT IN ACUTE APPENDICITIS I have been informed in detail about this research study by audio-visual means.

2. I have also been informed about the various complications; medical or technical, temporary or permanent, immediate or long term etc which may arise during the course of this study and has been allowed to ask questions regarding the study.

3. This has been explained to me in the language of my understanding.

4. After understanding all information, i am signing this consent letter without any force or coercion.

Signature of the Patient: - Signature of Witness: -

Date: Date

ABBREVIATIONS

- CRP - C - reactive protein
- IPD - In Patient Department
- IV - Intravenous
- OPD - Out Patient Department
- RIF - Right Iliac Fossa
- TLC - Total Leukocyte Count
- USG – Ultrasonography
- PPV- Positive Predictive Value
- NPV- Negative Predictive Value

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